High-elevation mass loss of Greenland increasing

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ABSTRACT BODY: The Greenland Ice Sheet is losing mass at an accelerated pace. Presently, the mass loss is assumed to be distributed approximately equally between loss in the form of surface melt (surface mass balance, SMB) and solid ice discharge (iceberg calving, D) along the margins. As part of the PROMICE project, repeated airborne LIDAR and radar surveys were carried out along the entire margin of the Greenland ice sheet in the years 2007 and 2011, providing bed and surface elevation profiles. Using these profiles, we establish a flux gate along the flight path, passing through 19 drainage basins. To obtain a depth-averaged flow speed, the observed surface flow speeds were adjusted with respect to several different flow regimes defined by the ratio of a SAR-derived surface velocity to ice thickness and driving stress. With the ice thickness and depth-averaged flow speed known we then estimate the solid mass flux passing through the flux gate in 2007 and 2011 in each of the basins. To isolate D (i.e., the contribution to sea level rise from solid ice discharge at the coasts), SMB values for the areas between the gate and the grounding lines in the basins were obtained from a regional climate model. We compare the calculated mass losses between the two years integrated over the entire ice sheet, but also on a basin-by-basin level to investigate internal redistribution of mass between the basins over time. We find a ~3% mean increase in mass loss per year at the ~1600 m elevation of the flux gate.

KEYWORDS: 0726 CRYOSPHERE Ice sheets, 0758 CRYOSPHERE Remote sensing, 0774 CRYOSPHERE Dynamics.

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Additional Details

Previously Presented Material: 50% of the work in an unfinished version has been shown on a poster at the CLIVAR workshop in Beverly, MA, June 2013.

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